CORE organic II

BIO-INCROP

Innovative cropping practices to increase soil health of organic fruit tree orchards

Aim of the project:

- To estimate the weight of biotic components on yield losses due to replant problems in apple and citrus orchards of specialized fruit tree-growing areas in Europe.
- To evaluate whether it is possible to maintain or increase fruit tree production in multi-generation orchards by exploiting microbial resources indigenous to soil using appropriate cropping practices.
- To evaluate, by using bio-assay, several agronomic means (organic amendments, cover crops, bio-formulates) to overcome replant problems in the organic apple and citrus orchards of Europe according to the constraints of different agro-environments where they are grown.

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Main outcomes at this stage?

Plant growth assay is an effective option to evaluate soil health of multi-generation apple orchards in temperate agro-environments where soil organic matter does not represent a limiting fertility factor.

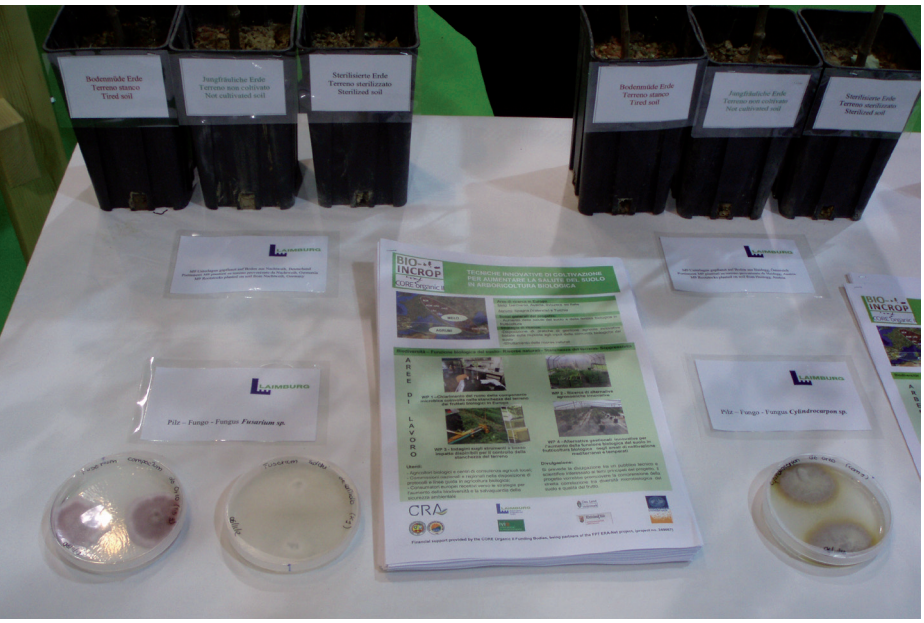
Soil enzymes are very useful indicators of changes in soil quality when converting degraded citrus to organic management in Mediterranean environment. Replant disease in organic and conventional apple orchards, in central Europe, has a consistent biotic origin which is responsible for about 30 % of growth reduction in multi-generation orchards.

Fungal pathogens are responsible for growth reduction due to apple replant disease, however they represent the minority of total soil fungi which colonize roots. To the contrary, several soil inhabiting microorganisms have potentiality to induce root growth and they represent a resource to be exploited for increasing plant growth/soil health.

Pre-plant treatment in multi-generation apple orchards with different organic amendments and cover crops showed a variable effect on growth of newly-planted fruit trees; it ranged from negative to positive.

Techniques based on the application of organic matter shortly before replanting are not successful in total control of soil-borne diseases in citrus degraded orchards, but do reduce the damage to soil organic matter and biological activity that more aggressive techniques such as solarization cause. A larger build-up of organic fertility seems necessary to reclaim severely infected citrus orchards, previously destined for replanting, to make rapid colonization by Phytophthora difficult. Vegetal covers seem very promising in this respect as they cause a large stimulation of biological activity in soil.

Two over ten bio-formulates evaluated among those available on the market were effective for controlling *Phytophthora cactorum* attack on newly-planted apple trees, while none resulted effective in reducing common replant disease. In citrus, on the other hand, commercial bio-formulates did not show any effectiveness against soil-borne diseases and when some nutritional effects were found, they could be related to the inorganic content of the formulate.

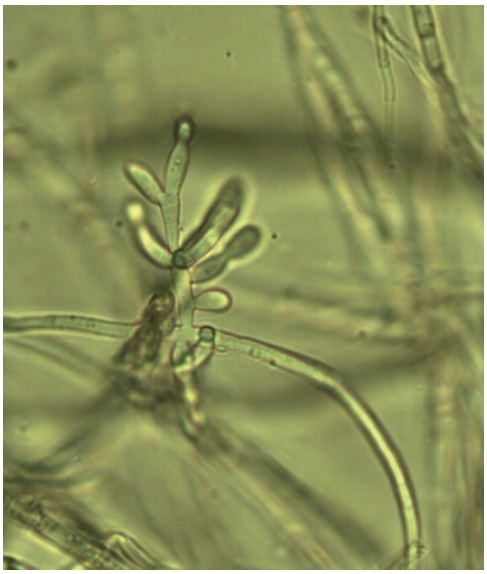


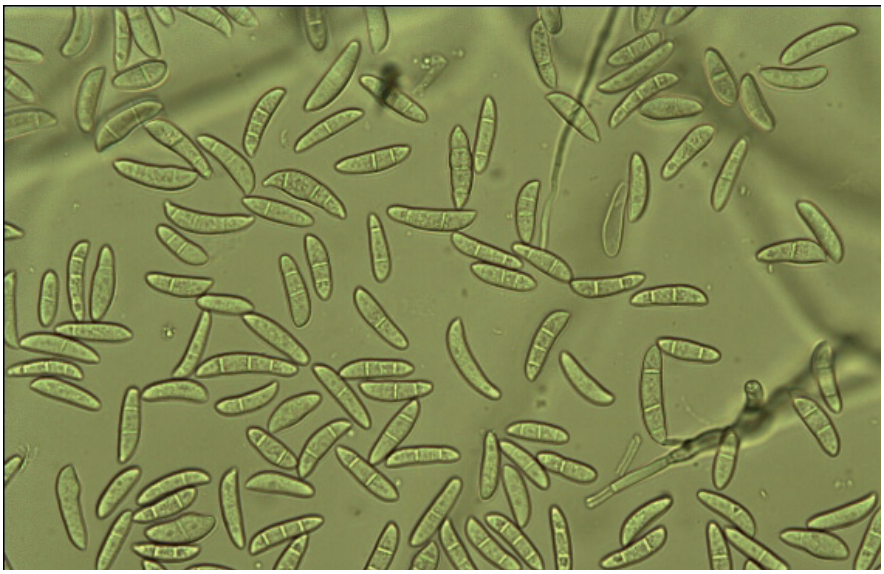
Recommendations to end-users

Permanent cropping systems where soil organic matter content is not a limiting fertility factor hold natural potential to increase plant growth; thus, researchers, in cooperation with local experimental centers and farmers, can develop cropping strategies focusing on soil microbial resources indigenous to soil in most of apple-growing regions of Europe.

Plant-microbial interaction is central in selecting cover crops and organic amendments in research frameworks aimed at identifying practices suitable for increasing soil health in organic and sustainable orchards of specialized apple growing areas in Central Europe.

Conventional production of citrus has caused a severe reduction of soil organic matter content and biological activity, giving rise to an increase of soil-borne diseases, since pathogenic fungi survive in soil and rapidly colonize the roots. The organic farmers must take into account that aggressive disinfection techniques suppress microbial life in soil, thus hampering its role as a health and fertility agent. Techniques based on organic matter are therefore not only recommended but necessary.





Conidia and conidiogenous cells of a nonpathogenic Fusarium inhabiting in apple tree roots.

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New and important research questions

Is it possible to set up cropping practices for specifically increasing beneficial soil inhabiting microbial populations and obtain positive results on plant growth over a short-medium period, such as for example the conversion period to the organic?

Can the exogenous microorganisms act in a more competitive way compared to indigenous microbial population, in mitigating yield decline affecting fruit tree orchards?

As Phytophthora is hard to eradicate from citrus soils, can strategies be developed to make a rapid beneficial colonization of roots in newly-planted trees?

Find all publications at orgprints.org/view/projects/BIO-INCROP.html.

Further information

This project is funded via the ERA-net CORE Organic II by national funds to each partner. CORE Organic II is a collaboration between 21 countries on initiating transnational research projects in the area of organic food and farming. In 2011, CORE Organic II selected this project and 10 more for funding.

Read more at coreorganic2.org/BIO-INCROP.